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REVISIONS

SYM	DESCRIPTION	DATE	APPROVAL
B	Retyped	2-3-67	MS

1/2 CU IN MULTIPLYING MODULATOR

General:

This ultra-miniature unit provides the true product over a wide bandwidth of an ac signal by a dc to wide band signal.

Features:

No hysteresis
 1/2 cu. size
 Phase shift less than 1/2 degree over 380 to 420 HZ
 3DB Bandwidth Output: 10 to 100,000 HZ
 Inherently resistive multiplication

Applications:

Variable gain control in Flight Control and Radar Systems
 Non Linear Corrections
 Squaring

Specifications:

Input 1: 0 to +0.75V DC to 100K HZ 10K ohms resistive min. overload to 10V without damage.
 Input 2: 0 to 0.75V RMS DC to 100K HZ, into 10K ohms resistive min. Overload to 10V without damage.
 Output: 0 to 250MV RMS nominal from 100 ohms max. output impedance. Load, 5K ohms minimum.
 Output 3DB Bandwidth: 10HZ to 100 KHZ min.
 Scale Factor: Unit to Unit 5%.
 Null: +2% Full Scale (measured at 400 HZ)
 Linearity: +2% Full Scale
 Gain Stability: +3% Full Scale, over operating temperature.
 Null Stability: +2% Full Scale, over operating temperature.
 Phase Shift: $\pm 1/2^\circ$ max. over 380 to 420 HZ
 Distortion: 2% (measured at 400 HZ)
 DC Power: 3 wire + and -15V $\pm 1\%$ at 5 ma max.
 Note: + and -12V DC power when so ordered
 Size: 0.6" high x 1" square
 Operating Temperature: -55 to +85°C will operate to 125°C at reduced accuracy.

DIMENSIONAL TOLERANCES UNLESS OTHERWISE SPECIFIED			DRAWN JP	DATE 2/67	TITLE MODEL 365 MULTIPLYING MODULATOR	TRANS  MAGNETICS 134-08 36TH ROAD / FLUSHING 54, NEW YORK	
2 PL. DEC.	3 PL. DEC.	ANG.					
±	±	±	CHECKED	DATE	SCALE	SIZE A	365A001
			APPROVED MS	DATE	CODE: 17755	SHEET 1 OF 1	B

TRANSMAGNETICS INC.

NEW ADDRESS . . .

TRANSMAGNETICS INC.

134-25 NORTHERN BOULEVARD
FLUSHING, NEW YORK 11354
PHONE: 212-539-2750
TWX: 710-582-2472

SOLID STATE SYNCHRO AND COMPUTING SYSTEMS

SINE WAVE
MODULATORS

ANALOG
MULTIPLIERS
DIVIDERS,
SQUARERS
AND SQUARE
ROOTERS

CURRENT
SENSORS

SENSITIVE
MAGNETIC
AMPLIFIERS

FREQUENCY
TO DC
CONVERTERS

DEMODULATORS
AC TO DC
CONVERTERS

SENSITIVE
SOLID STATE
RELAYS AND
MONITORS

COMPARATORS

SCR SERVO
DRIVES



CATALOG
665

TRANS MAGNETICS INC.

134-08 36th ROAD/FLUSHING 54, NEW YORK/212 LENOX 9-2750

MODULATORS • DEMODULATORS • ANALOG MULTIPLIERS
SENSITIVE SWITCHES • SCR DC MOTOR DRIVES • DC AMPLIFIERS
AC TO DC PRECISION CONVERTERS • CURRENT SENSORS

MODEL 195A

DC-100 KC BANDWIDTH
MULTIPLIER-MODULATOR

$V_0 = .3V_1 V_2$

V_1, V_2 each 0 to ± 1 V into 100 Ω

ACCURACY: $\pm 2\%$ FS

NULL: Less than 1% FS with 1 input zero, 2nd input at Full Scale (400 CPS)

POWER: +15 V DC @ 20 MA Max
-15 V DC @ 5 MA Max

MODEL 650

"SOLID-STATE"
SYNCHRO TRANSMITTER
without moving parts

ACCURACY: to 6 minutes

OUTPUT: 3 wires, 11.8 V 400 CPS L. to L. to drive. 2 Size 11 Synchro Receivers

INPUTS: 0 to ± 10 VDC proportional to sine and cosine of the angle

POWER: 40 VDC; 26V 400 CPS

Also available with input DC proportional to the angle instead of the sine and cosine

MODEL 335

1/5 CU. IN. AC SWITCH

AC signal switched on by 2 V DC at 200 μ A

SIGNAL IN: 0 to 5 V, 50 to 1000 CPS

ON OUTPUT: 0 to 1 V, 10 K source imp.

OFF OUTPUT: 3 MV Max

SWITCHING TIME: 10 μ s Max

SIZE: .56" sq. x 0.4", PC leads on 0.2" grid

OPERATING TEMPERATURE: -55 to +105°C

SENSITIVE SOLID STATE CONTROL RELAYS

LEVEL DETECTORS: for FAILURE DETECTION • ALARM MONITORING • ANALOG TO ON/OFF • LIMIT SWITCHING

MODEL	DETECTS	SET POINT	OUTPUT ON WHEN INPUT LEVEL	INPUT IMPEDANCE	SIZE	POWER	OUTPUT
916	AC Level	1 to 26 V, 400 CPS	Higher Than Set Point	30 K Ω	1 $\frac{1}{2}$ " Sq. x 1 $\frac{1}{2}$ "	26 V, 400 CPS	27 V DC @ .2A
940	AC Null Level	50 MV to 1 V, 400 CPS	Below Set Point	30 K Ω	1 $\frac{1}{2}$ " Sq. x 1 $\frac{1}{2}$ "	26 V, 400 CPS	27 V DC @ .2A
922	(Amplifier Input) > Set Point	15 to 200 MV DC	Between + and - Set Point; Off Above + and Below - Set Point	30 K Ω	1 $\frac{1}{2}$ " Sq. x 2 $\frac{3}{8}$ "	26 V, 400 CPS	27 V DC @ .2A
960	Logic Response, Low DC, and/or High AC Null	+15 V DC and 1 V, 400 CPS	Both DC Input Above and AC Input Below Set Point	30 K Ω	1 $\frac{1}{8}$ " x 1 $\frac{1}{4}$ " x 1 $\frac{7}{8}$ "	26 V, 400 CPS	27 V DC @ .2A

COMPARATORS:

MODEL	DETECT INPUTS	RANGE	OUTPUT ON WHEN	INPUT IMP.	SIZE	OUTPUT	POWER
982	A > B	0 - 1 MA DC	A > B	700 Ω EA.	1 $\frac{1}{2}$ " Sq. x 2 $\frac{3}{8}$ "	27 V DC @ .2A	26 V, 400 CPS
970	A-B > 0	-1.5 - +1.5 V DC	A-B > 0	10 K Ω EA.	1 $\frac{3}{4}$ " x 1 $\frac{7}{8}$ " x 2 $\frac{3}{8}$ "	27 V DC @ .2A	26 V, 400 CPS
984	A > B	0 - .5 V, 400 CPS	A > B	10 K Ω EA.	1 $\frac{1}{2}$ " Sq. x 2 $\frac{3}{8}$ "	27 V DC @ .2A	26 V, 400 CPS

BINARY SWITCHING OUTPUTS FROM ANALOG INPUTS:

MODEL	DETECTS	OUTPUT #1 ON	OUTPUT #2 ON	INPUT IMP.	POWER	OUTPUT	SIZE
930	High Low AC Current	Input > 200 MA	Input < 20 MA	< 5 Ω	26 V, 400 CPS	27 V DC .2A EA.	1 $\frac{3}{4}$ " x 1 $\frac{7}{8}$ " x 2 $\frac{3}{8}$ "
983	3 Level AC Input 0 to 125 V, 400 CPS	ON: 10 < V < 40; OFF: V < 10; V > 40	ON: > 40 OFF: < 40	> 100 K Ω	26 V, 60 CPS	27 V DC .2A EA.	1 $\frac{1}{2}$ " SQ. x 2 $\frac{3}{8}$ "

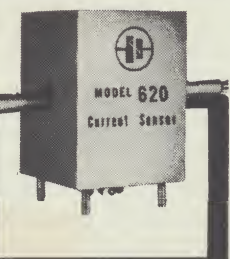
CURRENT SENSORS - CONDITIONERS

OVERCURRENT SWITCHING - TELEMETERING:

MODEL	INPUT	INPUT RES.	SENSING HOLE	OUTPUT	LOAD	POWER	SIZE	OPER. TEMP.
620	0 to 20A DC	—	$\frac{3}{8}$ "*	0 to 5 V DC	5 K Ω	40 V 400 Ω	1 $\frac{3}{4}$ " x 1 $\frac{7}{8}$ " x 2 $\frac{3}{8}$ "	-65 to +85°C
630	0 to 1A 400 CPS	< 1 Ω	—	0 to 5 V DC	5 K Ω	18 V DC	1 $\frac{1}{2}$ " Sq. x 1 $\frac{1}{4}$ "	-30 to +71°C
660	1 to 5A DC	—	$\frac{5}{32}$ "*	.5 to 3.5 V DC	600 Ω	20 V PP 18 KC	$\frac{3}{4}$ " D x $\frac{1}{2}$ "	-55 to +85°C

* Wire passes through without line interruption.

THIS SHEET FOR REFERENCE. DETAILED DRAWINGS AND SPECIFICATIONS ARE AVAILABLE ON REQUEST.



TRANS MAGNETICS INC.

TWX 212-539-2653

134-08 36th ROAD/FLUSHING 54, NEW YORK/212 LEnox 9-2750

MODULATORS • DEMODULATORS • ANALOG MULTIPLIERS
SENSITIVE SWITCHES • SCR DC MOTOR DRIVES • DC AMPLIFIERS
AC TO DC PRECISION CONVERTERS • CURRENT SENSORS

SINE WAVE MODULATORS

for DC to LOW DISTORTION AC PROPORTIONAL OUTPUT



Fully Isolated Input, Output, Excitation
DRIFT: To 100 μ V over -55 to $+105^{\circ}\text{C}$
LINEARITY: To 0.05% FS
GAIN STABILITY: To 0.1% over -55 to 105°C
NULL: To 500 Microvolts
CARRIER: 50 CPS to 500 KC
POWER OUTPUT: To $3\frac{1}{2}$ Watts

SIZE: As small as $\frac{1}{8}$ cu. in.
WEIGHT: Down to $\frac{1}{2}$ oz.
DISTORTION: As low as 1%
HYSTERESIS: To essentially zero
MULTIPLE INPUTS: For Algebraic Addition
Full Wave Modulation — Phase Sensitive
Current or Voltage Conversion
VOLTAGE INSULATION: To 2000 volts



MODEL 146
1/3 Cu. in.
servo mod.

MODEL 165
1 cu. in.
0.2% Lin.

MODEL 169
 $1\frac{1}{8}$ cu. in.
5V. out, low null

MODEL 152
0.1% Lin.
precision

MODEL 191
5V out
0.2% Lin.

MODEL 214
Low Null
Fast response

MODEL 175
Multiplying
modulator

MODEL 140
4 isolated inputs
add. & sub.

MODEL 120
2000V sig.
insulation

MODEL 172
30 KC
Carrier

MODEL	120	140	146	152	165
Input Signal — DC	#1 = 0 to $\pm 200 \mu$ a #2 = 0 to $\pm 500 \mu$ a	4 Inputs Each 0 to $\pm 150 \mu$ a	0 to $\pm 100 \mu$ a	0 to ± 7 V	0 to ± 7 V
Input Impedance	1 K Ω ea. max.	1 K Ω Each	10 K Ω max.	100 K Ω min.	100 K Ω min.
Output — AC	0 to ± 2.4 V	0 to ± 2 V	0 to ± 2 V	0 to ± 1 V	0 to ± 1 V
Output Load	50 K Ω	20 K Ω	10 K Ω	50 K Ω	50 K Ω
Linearity	3% FS	3% FS	2% FS	0.1% FS	0.2% FS
Gain Stability Over -55 to $+85^{\circ}\text{C}$	10%	10%	10%	3% (0.1% Special)	3% (0.2% Special)
Null	20 MV	30 MV	10 MV	3 MV	5 MV
Null Drift Over Temperature	20 MV	20 MV	5 MV	1 MV	1 MV
Phase Shift	$\pm 5^{\circ}$	$\pm 10^{\circ}$	$\pm 10^{\circ}$	$\pm 3^{\circ}$	$\pm 5^{\circ}$
Distortion	30%	5%	20%	2%	2%
3 DB Band Width — CPS	13 (15 K Ω Source)	13 (15 K Ω Source)	300	200	300
Excitation	26 V, 400 CPS	26 V, 400 CPS	23 to 29 V 380-420 CPS	26 V, 400 CPS	115 V, 400 CPS
Size — Inches	$1\frac{1}{2}$ Sq. x $2\frac{3}{8}$	$1\frac{1}{8}$ x $1\frac{1}{4}$ x $1\frac{7}{8}$	.763 Sq. by .61 in. on PC GRID	$1\frac{1}{8}$ x $1\frac{1}{4}$ x $1\frac{7}{8}$	$\frac{1}{2}$ x $1\frac{1}{8}$ x $1\frac{3}{4}$
Weight — Oz.	8	4.5	0.5	4.5	1

SEE OPPOSITE PAGE

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AC-DC CONVERTERS

OUTPUT IS PROPORTIONAL TO MAGNITUDE OF
AVERAGE OF FULLWAVE RECTIFIED INPUT



MODEL	INPUT	INPUT IMPEDANCE	OUTPUT	LOAD	LINEARITY	STABILITY -40 to +71°C	SIZE	POWER SUPPLY
638	DC and AC, 60 to 5000 CPS, 0 to 50 MV	100 KΩ	0 to 1MA. DC	250 to 1500 Ω	±0.5% FS	1%	2" x 2" x 3"	25-31 V DC 15 MA. MAX. +44 MA. Relay to select AC or DC input
625	0 to 5 V RMS 400 CPS	30 KΩ	0 to 5 V DC	50 KΩ	±0.5% FS	1%	1 1/32" Sq. x 1 1/16"	18 V @ 20 MA
643	.2 to 1 AMP., 400 CPS	< .05 Ω	0 to 5 V DC	100 KΩ	±1%	2%	1 1/32" Sq. x 1 1/16"	30 V @ 10 MA

DEMODULATORS, PHASE SENSITIVE

for AC TO DC PROPORTIONAL CONVERSION



MODEL	835	840	845	850	855	860
AC Input	0 to 10 V 400 CPS	0 to 5 V 400 CPS	0 to 85 MV 400 CPS	0 to 5 V 400 CPS	0 to 10 V 400 CPS	14 V Peak 400 CPS
Input Impedance	30 KΩ MIN.	50 KΩ MIN.	100 KΩ MIN.	100 KΩ MIN.	12 KΩ	Equals Load
DC Output	0 to ±10 V	0 to ±4.3 V	0 to ±150 μA	0 to ±4.5 V	60 MV/degree Around Quadrature 500 to 1 Quad. Rej.	10 MA MAX.
Into Load	100 KΩ	100 KΩ	500 Ohm Meter	50 KΩ	10 KΩ Resistive	—
Excitation	115 V 400 CPS	26 V 400 CPS	26 V 400 CPS	+25 V DC 115 V 400 CPS	8 V P.P. Sq. Wave 400 CPC ±15 V DC	6 V, 400 CPS Internal Transformer
Null	0.5% FS	0.5 MV	1 μA	0.06% FS	6 MV	3 MV
Linearity	1.0% FS	0.1% FS	2% FS	1% FS	0.5% FS	—
Gain Stability over -55 to +85°C	2% STD.	1%	2%	5%	1%	—
3 db Freq. Response	100 CPS MIN.	150 CPS MIN.	10 CPS	To 300 CPS External Filter. Unfiltered Internally	To 300 CPS External Filter. Unfiltered Internally	—
Ripple	100 MV MAX.	1%	—	—	—	—
Size	1 1/32" SQ x 2 1/8"	1" x 1" x 1 1/8"	1 7/8" x 1 3/4" x 2 3/8"	1" x 1" x 1 1/8"	1 1/8" x 1 1/4" x 1 7/8"	3/4" SQ. x .6"
Weight—Oz.	4	2.5	4	2.5	4.5	0.5

SEE OPPOSITE PAGE

MODEL	169	172	175	191	214
Input Signal — DC	0 to ±200 μa	0 to ±300 μa	0 to ±5 V	0 to ±5 V	0 to ±7 V
Input Impedance	10 KΩ max.	12 KΩ max.	50 KΩ min.	10 KΩ min.	100 KΩ min.
Output — AC	0 to ±5 V	0 to ±2 V	0 to ±1 V	0 to ±5 V	0 to 1.5 V
Output Load	20 KΩ	10 KΩ	10 KΩ	50 KΩ	50 KΩ
Linearity	2% FS	5% FS	1% FS of DC 1% FS of AC	0.2% FS	0.5% FS
Gain Stability Over -55 to +85°C	5%	5%	2%	8%	5%
Null	5 MV	50 MV	10 MV	5 MV	1.5 MV
Null Drift Over Temperature	2 MV	50 MV	10 MV	3 MV	1 MV
Phase Shift	±5°	Not Controlled	±10°	±5°	±3°
Distortion	5%	10%	10%	2%	2%
3 DB Band Width — CPS	300	1 KC	50 (15 KΩ Source)	300	< than 3° Phase Shift at 30 CPS Modulation
Excitation	26 V, 400 CPS	5 V, 30 KC	26 V ± 10% 380-420 CPS	26 V, 400 CPS	26 V, 400 CPS
Size — Inches	1/2 x 1 1/8 x 2 1/4	1 3/4 x 1 7/8 x 3/4	1 1/8 x 1 1/4 x 1 7/8	1 1/8 x 1 1/4 x 1 7/8	1 1/8 x 1 1/4 x 1 7/8
Weight — Oz.	1.2	2	3.5	4.5	4.5

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MULTIPLIERS • DIVIDERS (VARIABLE GAIN AMPLIFIERS)

MODEL 300 AX
 $AC \times DC = AC$



MODEL 340
 $DC \times DC = AC$



MODEL 350
 $DC \times DC = DC$

MODEL 360
 $AC \times DC = DC$

MODEL 430
 $AC \div AC = AC$

MODEL 440
 $AC \div DC = AC$

for MULTIPLICATION • DIVISION • SQUARING • SQUARE ROOTING

MODEL	FUNCTION	INPUT A	INPUT B	INPUT A IMPED.	INPUT B IMPED.	OUTPUT	LOAD	LIN- EAR- ITY	Gain Stability -55 to +85°C	SIZE
300AX	$V_O = K(I_{A1} + I_{A2})V_B$	0 to $\pm 100 \mu A$ EA. DC	0 to 2 V, 400 CPS	2600 Ω EA.	500 Ω	0 to 1 V, 400 CPS	10 K Ω	2%	2% Std.	1" x 1 1/8" x 1 1/8"
340	$V_O = K V_A V_B$	0 to ± 10 V DC	0 to ± 10 V DC	100 K Ω	100 K Ω	0 to 1 V, 400 CPS	10 K Ω	2%	2% Std.	1 1/2" Sq. x 2 3/8"
350	$V_O = K V_A V_B$	0 to ± 10 V DC	0 to ± 10 V DC	100 K Ω	100 K Ω	0 to ± 6 V, DC	10 K Ω	2%	2%	1 7/8" x 1 3/4" x 2 3/8"
360	$V_O = K V_A V_B$	0 to ± 10 V DC	0 to 2 V, 400 CPS	100 K Ω	500 Ω	0 to ± 1 V, DC	10 K Ω	2%	2%	1 1/2" Sq. x 2 3/8"
430	$V_O = K V_A / V_B$	0 to 40 MV, 400 CPS	1.25 to 50 V, 400 CPS	100 K Ω	100 K Ω	0 to 1.4 V, 400 CPS	10 K Ω	incl. in Gain	$\pm 10\%$	1 7/8" x 1 3/4" x 2 3/8"
440	$V_O = K V_A / V_B$	0 to 1 V, 400 CPS	3 to 12 V DC	100 K Ω	100 K Ω	0 to 1.5 V, 400 CPS	10 K Ω	2%	2%	1 7/8" x 1 3/4" x 2 3/8"
-441	SAME SPECIFICATIONS AS MODEL 440 - MINIJATURIZED									1 1/8" x 1 7/8" x 2 3/8"

MAGNETIC AMPLIFIERS

LOW LEVEL • HIGH GAIN • FULLY ISOLATED

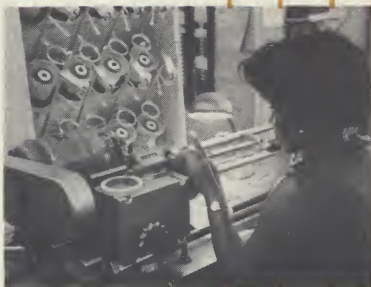
MODEL	NO. OF INPUTS	DC Ω EA. INPUT	INPUT μA DC	DC OUTPUT	LINEARITY	LOAD	POWER	Freq. and over -55 to 85°C For 10% Var. in Line Volt &		SIZE
								NULL	GAIN STABILITY	
537	4	90 Ω	0 to ± 250	0 to ± 5 V	$\pm 0.5\%$	1 K Ω	115 V, 400 CPS	40 MV	2%	1 1/8" Sq. x 3"
550	4	700 Ω	0 to ± 100	0 to ± 5 V	$\pm 0.25\%$	1 K Ω	115 V, 400 CPS	40 MV	2%	1 1/8" Sq. x 3"

FREQUENCY TO DC CONVERTERS

MODEL	INPUT FREQ.	INPUT VOLTAGE	INPUT IMPED.	OUTPUT	LOAD	POWER	SIZE	OPER. TEMP.
709	360 - 440 CPS	80 to 150 V RMS	50 K Ω	0 to 5 V DC	50 K Ω	28 V $\pm 10\%$ DC	1 3/4" x 1 7/8" x 2 1/8"	-40 to +71°C
718	100 - 400 CPS	30 to 115 V RMS	4 K Ω	1.25 to 5 V DC	7.5 K Ω	from Signal	1 1/2" Sq. x 2 3/8"	-55 to +95°C

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Designs Meet MIL-E-5400, MIL-T-21200, MIL-E-5272 And Equivalent Specifications.

- Engineering Representatives At Your Door. See List In Latest Issues Of EEM, EBG.
 - Quality Control To MIL-Q-9858.



TRANSMAGNETICS INC

LITHO USA CAT-765-20M